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Teaching lower level computer science courses via virtual classroom and video : course reports by faculty

Computerized Conferencing & Communications Center

Starr Roxanne Hiltz
Upsala College, roxanne.hiltz@gmail.com

Fadi Deek
New Jersey Institute of Technology

Maura Deek
New Jersey Institute of Technology

James Geller
New Jersey Institute of Technology

See next page for additional authors

Authors
Computerized Conferencing & Communications Center, Starr Roxanne Hiltz, Fadi Deek, Maura Deek, James Geller, and Ajaz R. Rana

TEACHING LOWER LEVEL COMPUTER SCIENCE COURSES VIA VIRTUAL CLASSROOM AND VIDEO

COURSE REPORTS BY FACULTY

CIS 113- Fadi and Maura Deek

CIS 114- James Geller

CIS 280- Ajaz Rana

Edited by Starr Roxanne Hiltz, Project Director

Research Report Number 29

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Introduction

New Jersey Institute of Technology is the grateful recipient of a generous grant from the Alfred P. Sloan Foundation which has enabled it to explore the use of asynchronous learning networks to create and deliver an entire undergraduate degree program in computer and information science. Each of these courses uses some amount of lecture-type material delivered via videotape. These materials are usually available to students in three different ways: by viewing broadcasts on a New Jersey cable station, by renting the set of videotapes, or by viewing in a special room in the library. Videotapes for distance learning are not new and are not, in themselves, a very effective means of delivery. The innovative part of this project is the Virtual Classroom™ which is a specially tailored set of features embedded in New Jersey Institute of Technology's computer conferencing system, EIES (Electronic Information Exchange System). This makes possible a rich interchange and collaboration among students and faculty as they discuss and work through the problems and concepts in a course.

As of the spring of 1995, both the B.A.I.S and the B.S.C.S. are available to distance and on-campus students. Teaching in a Virtual Classroom mixed with other media (such as video or CD ROM) is not simple however. The purpose of the enclosed descriptions of experiences by faculty members is to familiarize prospective teachers using this media mix in the future with both some ideas for how to organize their online activities, and knowledge of problems that have been encountered. The faculty members were given a suggested outline of topics to include in their reports, but otherwise were free to include whatever they thought would be of most use to other faculty members in the future, teaching the same or similar courses.

Those who are interested in learning more about teaching and learning in ALN environments are referred to two book-length treatments: Starr Roxanne Hiltz, The Virtual Classroom: Learning Without Limits via Computer Networks (Ablex, Norwood NJ, 1994); and Linda Harasim, Starr Roxanne Hiltz, Lucio Teles and Murray Turoff, Learning Networks: A Field Guide to Teaching and Learning Online (MIT Press, 1995)

Starr Roxanne Hiltz, Project Director

CONTENTS

A Report on the Delivery of an Introductory Course in Computer Science Through the Virtual Classroom

Fadi P. Deek and Maura A. Deek
September 1995

This document describes two instructors first experience in teaching CIS 113 Introduction to Computer Science I to Distance Learning students using a combination of Computerized conferencing and Video. It is worth noting that the first instructor (F. Deek) is among the "first generation" of distance learning teachers at NJIT and has been working with remote students for the past eight years in courses delivered via Cable Television Network (CTN) and tape circulation supported with traditional mail, electronic mail, fax and telephone.

INTRODUCTION

This course is the first requirement of the computer science core and is usually taken in the freshman year by those students majoring in Computer Science, Information Systems, Mathematics, Physics, and Science/ Technology/ Society. Students entering CIS 113 exhibit a wide range of pre-college preparation. For many this would be their first contact with a computer. On the other hand, some would have taken a year or more of programming courses in High School. Finding a common ground is one of the challenges for the course instructor. Providing the students with a solid background in problem solving and programming to succeed in the subsequent course on data structures and algorithms is another challenge. No prerequisites are assumed for the course. However, Calculus I is a corequisite.

Multiple sections of the course are offered every semester and in both summer sessions. The same instructor, assisted by teaching assistants, teaches all day sections. The Virtual Classroom sections (Spring and Fall 94 sections) described in this report were also taught by the same day sections instructor (F. Deek). Subsequent sections were taught by a different instructor (M. Deek).

ABOUT THE COURSE

The course covers fundamentals of computer science with emphasis on problem solving and programming. Topics include basic concepts of computer systems, software engineering, algorithm design, programming methodology, and data abstraction. Upon successful completion of the course, students are expected to comprehend the structure and use of a computer system including the various software and hardware support facilities that are available, and the internal representation of information; to be able to use a high-level programming language and apply a disciplined approach to problem solving, algorithm development and program construction by use of top-down design techniques, including modular construction and stepwise refinement; and to acquire the necessary background for success in further study of computer science (Appendix 1 contains the complete course syllabus which was received by students taking the course).

DELIVERY OF CIS 113 THROUGH DISTANCE LEARNING

In the Fall of 1992 the instructor recorded 14 one and a half hours of lectures for CIS 113 while teaching the honors section in NJIT's Candid Classroom. Students taking the distance learning version of the course have been using these tapes since the Spring semester of 1993. On campus students also have also taken advantage of the tapes and are using them in the university Library for review after lectures.

During the Spring semester of 1994, the Virtual Classroom course was offered in accelerated mode for the first time. In the Fall of 1994, two VC sections of the same course were offered: regular and honors. In all of these sections, students would "sit in" on the lectures by either watching them on CTN or by tape circulation arranged by the Office of Distance Learning. All class interaction and correspondence with the instructor took place through the Electronic Information Exchange System (EIES) conferencing component.

Three face-to-face sections of CIS 113 were also offered during both of these two semesters. The VC instructor was also the on-campus instructor.

THE VIRTUAL CLASSROOM COMPONENT OF CIS 113

Computerized Conferencing

Students were initially sent a comprehensive package from the Office of Distance Learning describing the project, the program, plus an EIES manual and information, and an initial survey. Also included in this package were additional information from the instructor: a welcome letter, a class syllabus, and a list of required readings for the course. Items related to the course were also posted in the course conference at the beginning of the semester. Students were added to the conference as soon as they received their login accounts.

Initial discussions and interactions were generated as a result of the posting of an opening statement as the first item of the conference (Appendix 2 contains the opening statement) and instructor's self introduction. Students were asked to use the reply option of EIES to respond with their self introduction and other relevant information. Also a self-help assignment on using the basic functions within EIES was assigned. These two activities allowed the students to discover some necessary functions of EIES that were essential for the rest of the semester.

Conference interaction, throughout the semester, was both required and spontaneous. Each week, a detailed introduction to the week's lesson was posted in the conference, as well as the required reading (chapters and section) for the week (Appendix 3 contains samples of weekly topic introductions and assigned readings). An electronic problem solving session, involving the instructor and the students, was held every other week (Appendix 4 contains a complete sample problem solving session as developed by the instructor and students). Students were required to sign on the system at least twice a week, preferably after seeing the appropriate two video tapes of the week, and after reading the corresponding book chapter (s).

As a mean of "attendance" verification and to increase interaction, students were required to submit a weekly "class participation" assignment. This assignment consisted of the student posting a conference comment critiquing the subject matter discussed in the video and weekly reading. Students were encouraged to comment on the discussions submitted by fellow students and to encourage this communication the instructor commented on each student's weekly discussion. This requirement proved very successful. Students rarely "missed" classes, and when they did the work was made up with class participation.

Five programming projects were assigned. The last two involved group work. Due dates were based upon the complexity of the assignment and the class section (honors, accelerated, etc.) Rules regarding assignments were posted in the conference.

Students were to mail assignments on or before due dates. Assignments were reviewed for their strengths and weaknesses. Students were sent a private mail feedback message including comments on their solution as well as a grade. A version of the instructor's solution was posted in the conference after the due date. Students comments on the instructor's solution were encouraged.

Midterm and final exams were given on campus. Students who lived more than 100 miles from the campus were permitted to have the exam proctored (at workplace, other schools, etc.). Proctoring, however, was the exception rather than the rule. Exam dates and times were posted regularly. A week before the exam, a conference item that discussed the material to be covered was posted. This allowed the students to ask questions concerning a particular subject or problem.

The Problem Solving Session

Though initially intended to be an exercise in program development, the problem solving session became the heart of conferencing activities. Such sessions, students commented, helped them feel that "there was actually a classroom".

A sequence of well defined "activities" makes up a complete problem solving session. The session begins with the examination of a problem to be solved. With the introduction of the problem as the first activity of the session, we allow the students to engage in analyzing and defining the variables of the problem and to seek, discuss, and present possible solutions. The students concentrate and focus on the design of the algorithms, choice of data types and structures, and outlining the testing strategies. Once the algorithmic solution for the problem is constructed, the language syntax (i.e. control structures, data representation) necessary to carry out the solution to its final stages is then recalled (already introduced in the lecture tapes). This is accomplished by what we refer to as the *algorithmic walkthrough*. Each line in the algorithm is visually scanned, by the students and the instructor, to identify all new language features required in order to have a complete mapping of the algorithm into the language's syntax. Using both the algorithmic solution which the students develop in collaboration with the instructor and the language's grammar - now more meaningful and appreciated - the complete solution is implemented and tested.

This makes it possible for the students to get involved in class discussions from the beginning and throughout the duration of the problem solving session.

Statistical Information: Comparison of All Section Results

In Spring 1994, 5 sections of CIS 113 were offered: 2 face-to-face (ftf) sections, a distance learning section with video tape circulation only (dl), a VC plus video accelerated section (acc), and an evening section (eve).

In Fall 1994, 6 sections of CIS 113 were offered: 3 face-to-face (ftf) sections, a VC plus video regular section (reg), a VC plus video honors section (hon), and an evening section (eve).

Below is the grade comparison from all section of CIS 113 taught by the same instructors (on-campus day/VC honors/VC accelerated/VC Regular/on-campus evening.

SP 94

GRADE	ftf sec 1	sec 2	dl	VC (acc)	eve
A's	1	4	--	--	3
B+'s	--	1	--	5	--
B's	2	--	1	--	3
C+'s	4	2	--	--	1
C's	2	4	1	2	3
D's	--	--	1	--	5
F's	5	5	1	1	5
W's	9	2	3	--	11
Inc's	0	0	--	1	--
Total	23	18	7	9	31

Fall 94

GRADE	ftf sec 1	sec 2	sec 3	VC (reg)	VC (hon)	eve
A's	3	4	4	--	4	4
B+'s	4	1	3	--	2	--
B's	5	2	3	2	3	3
C+'s	1	3	1	2	--	2
C's	2	2	4	--	--	--
D's	2	2	1	3	--	2
F's	7	5	1	2	--	5
W's	3	2	4	4	2	4
Inc's	1	--	--	1	--	--
Total	28	21	21	14	11	20

GRADE	VC		ftf		dl	
A's	4	12%	23	14%	0	0%
B+'s	7	21%	9	6%	0	0%
B's	5	15%	18	11%	1	14%
C+'s	2	6%	15	9%	0	0%
C's	2	6%	17	10%	1	14%
D's	3	9%	12	7%	1	14%
F's	3	9%	33	20%	1	14%
W's	6	18%	35	20%	3	43%
Inc's	2	6%	1	1%	0	0%
Total	34 3 sections		163 7 sections		7 1 section	

GRADE	VC	ftf	dl	Total
A's and B's	16	50	1	67
C's and D's	7	44	2	53
F's	3	33	1	37
W's	6	35	3	44
Total	32 3 sections	162 7 sections	7 1 section	201

GRADE	VC	ftf	dl	Total
A's and B's	10.7	54	2.3	67
C's and D's	8.4	42.7	1.8	53
F's	5.9	29.8	1.3	37
W's	7.0	35.5	1.5	44
Total	32 3 sections	162 7 sections	7 1 section	201

Collapsing the data to make possible a significance test, we obtain the results below. Those sections using the Virtual Classroom are significantly more likely to obtain an A or B in the course than those in traditional ftf or all video sections. Those in video only are significantly more likely to withdraw.

Grade Distribution by Mode of Delivery, Introduction to Computer Science (CIS 113)

Mode	A or B	C or D	F	W	Total
VC+ Video	50%	22%	9%	19%	32 = 100%
FtF	31%	27%	20%	22%	162 = 100%
Video only	14%	29%	14%	43%	7 = 100%
All	67	53	37	44	201 = 100%

Chi Sq = 7.43 p= .30

TEACHING IN THE VIRTUAL CLASSROOM VS THE TRADITIONAL CLASSROOM

One of the obstacles to learning is the inability or unwillingness of students to grasp course content. In the traditional classroom setting, the instructor has opportunities to facilitate the learning process directly and indirectly through language, gestures, reinforcement material, and peer pressure. Such support mechanisms do not, for the most part, exist for the typical distant learner who, isolated, acquires information from videotapes, electronic and print material. However, as an instructor who is always willing to try new and different techniques and modes of teaching and learning, and based on my personal experience, I remain persuaded by the needs of the changing student population that the virtual classroom is one of the answers.

Several factors from which students benefit are to be taken into consideration:

1. Encouragement of student-centered learning/ minimization of teacher dependence;
2. Promotion of student integrity and honor system;
3. Exposure to intellectual independence and discovery.

SUMMARY

Technological applications in education are providing for an improved response to the demands of the changing student population. Televised and computerized media are permitting an increasing number of remote students to take better advantage of a wide variety of educational opportunities. Efforts must be geared toward maintaining a reasonably consistent learning environment and achieving parity with on-campus programs. The delivery of services beyond lecturing and electronic discussions is an area that must be addressed.

Distance learning has become a household word. Business organizations, telephone companies, cable and public broadcasting companies, and educators have placed it high on their agendas for the twenty first century. For those of us who are already providers of distance learning, we must find some answers for some important questions. We know that we can deliver rigorous programming to remote students because we have been doing it. We know that access issues are receding with the deployment of new and somewhat affordable telephone technologies. Furthermore, we know that distance learning offers more flexibility in meeting the needs of diverse learning styles and that most distant learners prefer to learn when it is convenient for them, i.e. in delayed time frames, rather than when it is convenient for the college, i.e. at a specific time or a specific place. The consequences of increased access, increased enrollment and demand for flexibility in educational programming delivery pose problems with faculty/student interaction, course pacing, deadlines, and assessment. Thus, distance learning posits great risks to the management of education. These risks challenge the faculty mentor who is conducting the courses as well as the students who are enrolled.

The most critical next step in the evolution of distance learning is the development of management strategies which counteract this welcome flexibility so that learner and teacher have a constant sense of who is learning what and when.

Appendix 1: Course Syllabus
(for the semester long section)

CIS 113 Introduction to Computer Science I
Course Syllabus for the Virtual Class
Fall 1995

1. Opening Note

This section of CIS 113 is offered via a combination of video and "Virtual Classroom". The material covered will be the same as in the regular sections of CIS 113. In the past students have found the material and the workload in this course rather challenging. Therefore, a substantial time investment into the course, on the order of 10 hours a week or more must be expected (this includes watching the tapes, participating in the electronic conference discussions, and doing the homework and projects).

Students are requested to meet on campus for an orientation session and two examinations unless it is not feasible geographically (***student lives in a different part of the country or over 100 miles away from NJIT***). Pretaped lectures will be broadcast via TV (or tape circulation). Discussions, weekly homework, and assignments will take place continuously in the Virtual Classroom, NJIT's computerized conferencing system. You will be expected to sign on-line at least two times a week using your PC and a modem or a terminal, if you are on campus.

2. Personnel

Instructor:	Maura Ann Deek
Office:	4400 Guttenberg Information Technologies Center (GITC)
Phone:	596-3366
Office Hours:	online
E-mail:	2085 or maura (EIES account)

3. Course Overview

Title: CIS 113 Introduction to Computer science I
Credits: 3
Co-requisite: Math 111

Description: Fundamentals of computer science are introduced, with emphasis on programming methodology and problem solving. Topics include basic concepts of computer systems, software engineering, algorithm design, programming languages and data abstraction, with applications. A high level language (such as Pascal) serves as the vehicle to illustrate many of the concepts. CIS majors should enroll in CIS 113. Students who receive degree credit for CIS 113 may not receive degree credit for CIS 213.

Goals: To understand the structure and use of a computer system including the various software and hardware support facilities that are available, and the internal representation of information and the underlying concepts in number system, and radix conversion;

To introduce a disciplined approach to problem solving, algorithm development and program construction by use of top-down design techniques, including modular construction and stepwise refinement;

To teach a block-structured high-level programming language;

To describe the application and implementation of advanced programming techniques and data structures;

To teach program design, coding, debugging, testing and documentation using good programming style;

To provide a foundation for further studies in Computer Science.

4. Topics (not necessarily in broadcast order)

1. Computer systems: Hardware Components (central processing unit, control unit, memory, input and output devices, and representation of information). Software (language translators, operating systems functions and characteristics, and other applications).

2. Problem solving and programming methodology (specification, design, implementation, and testing).

3. Basic types and operations.

4. Control structures (sequencing, selection and repetition).

5. Modular Design and abstraction (sub problems, scope, module interface, and recursion).

6. Software engineering (design quality, coupling, cohesion, and correctness).

7. Data abstraction, simple data types and sets.

8. Lists (static): One, two and multi-dimensional.

9. List applications: Searching and sorting.

10. Data structures: records, data abstraction, and files.

11. Lists (dynamic) and implementation of abstract data types as data structures.

12. Linked vs. linear storage; tradeoffs in space, flexibility, and speed.

13. Operations on data structures such as insertion, deletion, and traversals.

5. Textbooks

1. Brookshear, Computer Science: An Overview, Addison-Wesley, Fourth Edition, 1994.
2. Savitch, TURBO PASCAL, Addison-Wesley, Fourth Edition, 1993.

6. Assignments

Viewing:

The lecture part of this class will be broadcast by CTN (see above). If you cannot see the broadcast at that time, you must make sure that you see the corresponding Video Tapes by THURSDAY of the same week (feel free to tape the lessons for delayed viewing).

There will also be a room in the NJIT Library where you can view the tapes. More information on that will be posted in the conference.

Reading:

It is required that you read the textbook chapters in the above books after you watch the corresponding classes on Tape or CTN. Reading assignments will be posted on a weekly basis. There are some material covered in the book and will be the basis of electronic discussions, but are not on the tapes.

Homework:

Homework are of three kinds:
a) Weekly participation. Conference comments about what you learned from each week's lesson (the taped lecture and the reading assignment), what you liked most and least about this week's lesson, etc.

b) Interaction homework. There will be periodic *problem solving sessions* that require everyone's input and will be held after the second broadcast of the week. Your prompt answer will be expected (more details and deadlines will be announced on the system).

c) Programming projects. There will be 5 Pascal *programming projects* also posted on the system to be submitted electronically.

7. Examinations

There will be a midterm and a final exams to be taken on the NJIT campus. Exact dates, time, and location will be communicated electronically.

8. Grading

Midterm	25 %
Final	30 %
Interaction homework and class participation:	25%
Programming projects:	20 %

For exceptionally well done work a number of extra credit points will be given.

9. Late policies

Due to the nature of this course, no late Interaction Homework will be accepted (unless you have a good reason, such as documented illness). For programming assignments there will be late penalties for late submissions. Details will be announced in the assignment.

10. Academic Integrity

The work you do and submit is expected to be the result of your effort ONLY. You may discuss the high level (general) solution of a problem. However, cooperation should not result in one or more students having possession of a copy of all or part of a program written by another student. The penalty for violating the University's code may include failure in the course and probation.

11. Tutoring (if you are on campus)

There is help available in this class beyond the electronic boundaries. The instructor and the TA can answer any question related to topics covered on the tape, the conference, or the textbook, programming assignments, or any other related questions. Additionally, structured tutoring sessions for students who request it or need it is also available.

The CIS department runs a tutorial center located in room 4315 INFO. Tutors will help students with troublesome program problems.

The University Learning Center located in University Hall also runs a comprehensive tutorial program. Tutors at the center will assist the students in course and homework related problems and provide them with tutorial sessions.

12. Computing Needs

You will be using Turbo PASCAL on your NJIT PC (or any other PC available to you).

13. Time Schedule (CTN broadcast)

Tuesdays and Wednesdays, 3:30am to 4:00am, starting September 5 to December 13. On December 13, the lecture will air starting at 2:30 am to 4:00 am.

14. Broadcast Details

The course will cover 2 lessons per week (topics can be found in text 1 and 2 described above) in the following order. More on readings will be communicated electronically.

Lessons 1,2	Computer Organization and Operating Systems
Lessons 3,4	Introduction to Problem Solving and Programming
Lessons 5,6	Input, Output and Program Construction
Lessons 7,8	Modular Design and Abstraction
Lessons 9,10	Control Structures: Sequencing, Selection and Repetition
Lessons 11,12	More on Modular Design and Programming
Lessons 13,14	Software Engineering
Lessons 15,16	More on Control Structures: Selection and Repetition
Lessons 17,18	User Defined Structures
Lessons 19,20	Data Structures: Lists
Lessons 21,22	List Applications: Searching and Sorting
Lessons 23	Character Arrays, Strings and the Packed Option
Lessons 24	More on Data Structures: Records
Lessons 25	More on Data Structures: Files
Lessons 26	The Pointer Type
Lessons 27,28	Dynamic Structures: Linked Lists
Lessons 29,30	More on Dynamic Structures

15. Orientation Session

Remember that you MUST attend the orientation session on Tuesday September 5, 1995 from 4:00pm to 6:00 in the Guttenberg Information Technologies Center (GITC), room 4325, as described in the attached letter.

Appendix 2: Opening Statement

Welcome to the Virtual Classroom of CIS 113 - Introduction to Computer Science I

The goals of this course include a solid foundation to many of the important concepts to which students will be exposed to in their course of study. The outline for this foundation course covers the following basic areas:

1. Computer systems
2. Problem solving
3. Data representation and structures
4. Program development
5. Programming language syntax (Pascal).

We introduce problem solving techniques that are particularly useful in using a computer in a problem's solution. This is called programming. It is important, however, to realize that we, and not the machine, have the biggest burden of the problem solving task.

Distinguishing between the planning and designing phase on one hand and the coding (programming) phase on the other will help alleviate a typical problem: writing code without a clear understanding of the problem definition and/or its requirements that can and will often result in erroneous outcome.

We do not attempt to present programming language syntax at the same time we teach problem solving techniques and algorithm development. We cover the language syntax once we have identified our needs.

The organization of data is also an important aspect of the problem solving/implementation. Without a clear picture of the organization of internal storage, it is difficult to visualize how data is represented, stored and referenced within computers.

Regardless of the language used, it is more meaningful that problem solving be taught in parallel with the language syntax - not after. We use an English-like pseudocode language for presenting algorithm development and representation. This will enable us to produce an initial design and possible solution that is language independent and hence simple to develop.

As the course progresses, we should keep four important objectives in mind:

1. Laying a solid foundation in the areas of computer systems, problem solving and algorithm development, data structures, and program development.

2. Making a language-independent presentation of problem solving and data structures.

3. Keeping the discussion of computer system and problem solving concepts independent of any specific machine architecture and software tools.

4. Acquiring the skills to design, develop, document, test, and maintain programs.

Finally, no mathematical background is assumed in order to understand the material presented in this course. However, the curriculum requires that calculus I is a corequisite of this course, since the skills of forming and manipulating abstractions and in using analogy are very important in understanding the material presented here and in the following courses.

Appendix 3: Samples of Topic Introductions and Assigned Readings

The following is a ***introduction*** of the fifth week's broadcast:

Lessons 9 and 10 discussed Control Structures: Sequencing, selection and repetition. The notion of flow of control through a program refers to the order in which statements are executed. Although execution proceeds according to the actual order in which statements appear (sequential), it is often the case where the control flow may diverge and take on a logical path that is different from the physical one. In addition to the sequential control structure; selection and repetition are the three basic control structures common to all programming languages.

Frequently, the execution of a process depends on the logical outcome of a conditional expression (i.e. true or false). As a result, different actions may be taken. Programming languages use *selection control structure to* instruct the computer to determine which of the possible two cases is actually in effect, and to specify the action to be taken in each case. Selection can be one-way, two-way, or multi-way.

Repetition is a control structure that allows a process to be executed repeatedly, also based on a condition, during the program execution. There are numerous ways to control repetition including counting and event mechanisms. An important fact that must be verified and determined with repetition is the termination condition, otherwise the process of repeating could go on indefinitely.

Please ***read*** the following sections:

Lesson 9, 10 Control Structures: Sequencing, Selection and Repetition

Text 1: Ch 5 Sec. 5.1-5.4

Text 2: Ch. 3

Text 1: J. G. Brookshear, "Computer Science: An Overview"

Text 2: W. J. Savitch, "Turbo Pascal"

Appendix 4: Sample Problem Solving Session

What follows is a sample problem solving session as it is conducted in the conference. Each activity is labeled as a heading. The role of students and instructor are described and a selected **brief** example of the activity's output is included. The subject of this lesson is the selection control structure. This topic is generally covered in the second week of the semester.

The activities are as follows:

INTRODUCTION *(Instructor starts by an introduction to the topic to be covered)*

Example:
The notion of flow of control through a program refers to the order in which statements are executed. Although execution proceeds according to the actual order in which statements appear (sequential), it is often the case where the control flow may diverge and take on a logical path that is different from the physical one. In addition to the sequential control structure; selection and repetition are the three basic control structures common to all programming languages.

Frequently, the execution of a process depends on the logical outcome of a logical expression (i.e. true or false). As a result, different actions may be carried out. The *selection control structure is used to* instruct the computer to determine which of the possible two cases is actually in effect, and to specify the action to be taken in each case. Selection can be one-way, two-way, or multi-way.

PRESENTATION OF PROBLEM *(Instructor presents a problem that is intended to take into consideration the use of new material as defined in the syllabus for that specific week)*

Example:
As we all know, updating a checkbook (Balancing) is a task that some of us struggle with and others dislike. Luckily, we are learning about problem solving and programming now. Today we are going to computerize this annoying task at once.

ANALYSIS AND SPECIFICATIONS *(Students with instructor acting as facilitator discuss and document problem input, calculations, identify required formulas, and expected outcome)*

Example:
1. Discussions

First we need to know the transaction type, the starting balance, and the transaction amount. Once this is entered, calculations consistent with the transaction type (deposit or withdrawal) will take place. Finally, the result is displayed.

2. Data requirements
a) Input
Transaction type (character), starting balance (numeric), transaction amount (numeric).

b) Output
Transaction type (character), starting balance (numeric), transaction amount (numeric), ending balance (numeric).

c) Intermediate data
None

d) Named constants

None

3. Relevant formulae
For deposit:
ending balance = starting balance + transaction amount

For withdrawal:
ending balance = starting balance - transaction amount

<u>DESIGN</u> *(Students with instructor acting as facilitator perform several tasks starting with: 1) identifying all system components (modules) graphically using a design methodology such as top-down and step wise refinement techniques. 2) define each module specification including task to be carried out, input/output, and logic. 3) a possible solution outline is formed using an algorithmic language notation)*

Example:
1. Structure chart

First-level refinement

```
          Update
         checkbook
             |
 |-------------+------------|
 |             |            |
Get       Perform        Display
data      computation    results
```

Second-level refinement

```
             Get
             data
              |
 |------------+------------|
 |            |            |
Get         Get          Get
starting    transaction  transaction
balance     type         amount
```

```
        Perform
        computations
             |
             |
        Determine
        balance
```

```
             Display
             results
              |
 |------------+-------------|
 |            |             |
Print       Print         Print
starting    transaction   ending
balance                   balance
```

Third-level refinement

```
          Print
          transcation
               |
   |------------------|
   |                  |
Print              Print
starting           ending
balance            balance
```

2. Module specifications:

As an alternative method to further aid in understanding how data are transmitted, we will include module specifications for each main (first-level) module. Each module specifications include a description of data received, information returned, and logic used in the module.

Module specifications for the Get Data module are:

Get Data Module
- Data received: None
- Information returned: Starting balance, Transaction type, Transaction amount
- Logic: Have the user enter data from the keyboard.

For the Update checkbook problem, complete module specifications are

I. Get Data Module
- Data received: None
- Information returned: Starting balance, Transaction type, Transaction amount
- Logic: Have the user enter data from the keyboard.

II. Perform Computations Module
- Data received: Starting balance, Transaction type, Transaction amount
- Information returned: Ending balance
- Logic: If transaction is a deposit, add it to the starting balance; otherwise, subtract it

III. Display Results Module
- Data received: Starting balance, Transaction type, Transaction amount, Ending balance
- Information returned: None
- Logic: Print results in a readable form.

3. Algorithm:

1. Get data
2. Perform computations
3. Display results

A second-level development produces

1. Get data
   - 1.1 get starting balance
   - 1.2 get transaction type
   - 1.3 get transaction amount
2. Perform computations
   - 2.1 IF deposit

THEN add to balance
ELSE subtract from balance
3. Display results
3.1 print starting balance
3.2 print transaction
3.3 print ending balance

Step 3.2 of the algorithm is subdivided into

3.2 print transaction
3.2.1 print transaction type
3.2.2 print transaction amount

ALGORITHMIC WALKTHROUGH *(Students attempt to map the algorithmic solution into programming language syntax by going over each line in the algorithm and pointing out the exact language feature required))*

Example:
2.1 IF deposit
THEN add to balance
ELSE subtract from balance

IMPLEMENTATION *(Students and instructor attempt to fill in the gaps and produce a complete program that will run on the computer)*

Example:

```
PROGRAM Checkbook (input, output);

VAR
  StartingBalance, EndingBalance, TransAmount : real;
  TransType : char;

BEGIN { Main Program }

  { Module for getting the data }

  writeln ('Enter the starting balance and press <RETURN>.');
  readln (StartingBalance);
  writeln ('Enter the transaction type (D) deposit ',
         'or (W) withdrawal');
  writeln ('and press <RETURN>.');
  readln (TransType);
  writeln ('Enter the transaction amount and press <RETURN>.');
  readln (TransAmount);

  { Module for performing computations }

  IF TransType = 'D'
    THEN
      EndingBalance := StartingBalance + TransAmount
    ELSE
      EndingBalance := StartingBalance - TransAmount;

  { Module for displaying the results }

  writeln;
```

```
 writeln ('Starting Balance     $', StartingBalance:8:2);
 writeln ('Transaction          $', TransAmount:8:2,
        TransType:2);
 writeln ('---------':45);
 writeln ('Ending Balance       $', EndingBalance:8:2)
END. { of main program }
```

Notice how sections of the program correspond to module specifications. Sample runs of the program produce the output:

```
Enter the starting balance and press <RETURN>.
235.16
Enter the transaction type (D) deposit or (W) withdrawal and press <RETURN>.
D
Enter the transaction amount and press <RETURN>.
75.00

Starting Balance    $ 235.16
Transaction         $ 75.00 D
                     ----------
Ending Balance      $ 310.16

Enter the starting balance and press <RETURN>.
310.16
Enter the transaction type (D) deposit or (W) withdrawal and press <RETURN>.
W
Enter the transaction amount and press <RETURN>.
65.75

Starting Balance    $ 310.16
Transaction         $ 65.75 W
                     -----------
Ending Balance      $ 244.41
```

CIS 114 - Data Structures and Algorithms
James Geller

This report is about Virtual Classroom delivery of CIS - 114, the introductory Algorithms and Data Structures class. First I will describe the class itself, and then go into the particulars of my remote class sections.

CIS 114 at NJIT corresponds to the ACM curriculum CS 2 class, i.e., it is the second Computer Science class for majors. Anybody who is enrolled in CIS 114 is expected to have taken CIS 113, or an equivalent course, as prerequisite. CIS 113 introduces the students to the basics of PASCAL programming, leading up to a (superficial) coverage of linked lists. Students of CIS 113 learn design, editing, and debugging of programs by hands-on experience. In CIS 114 this elementary knowledge of Computer Science is then extended in the following ways: (1) The notion of Abstract Data Type is taught. (2) Standard Searching and Sorting Algorithms, such as Quicksort, Mergesort, Radix Sort, etc. and the commonly used mathematical formalism to describe the order of magnitude of their runtimes (the big Oh notation) are introduced. (3) Linked Lists, Stacks, Queues, Trees, and Graphs are covered as Abstract Data Types. (4) Some of the more intricate details of PASCAL are covered, such as use and misuse of variant records. (5) Topics that are traditionally not well understood by students of CIS 113 are reviewed, especially the use of recursion.

In the Spring of 1993 I recorded 40 half hour lectures of CIS 114 on video tape, using the staff and facilities of the Candid Classroom at NJIT. The normal scheduling practices at NJIT resulted in one two hour session per week, during which three half hour segments were recorded, and a second somewhat shorter session every week, where some topics were explained and extended without the ``threatening'' camera above everybodies heads.

During the Fall of 1993, I taught a first CIS 114 Virtual Classroom course. In this course, students would see the lectures on video tape or cable, and they interacted with me by using the EIES conferencing system. In the Spring of 1994 I taught the same class again, and an additional class called a ``double speed section.'' This section started in the middle of the semester and continued for (a little over) half of the normal semester.

In Fall 1993, CIS 114-451 had 8 registrants. Unfortunately, 5 withdrew, and one failed, leaving only two passing students (with grades A and B).

In Spring 1994, CIS 114-452 had 13 registrants. Of these three dropped the class. Of the remaining students two received A's in the normal time. Eight students received incompletes. Of these eight, seven finished the course within the allocated time to make up snow and tape problems. They received the grades: A, B+, B (2) C+, D, F. One student is currently making up this class.

In Spring 1994, CIS 114-454 had nine registrants. This is the double speed section. Of these, four registrants dropped the class. Three remaining students made use of the "short term incomplete" option and received the grades A and B (2). Two students have to date not made up their incompletes and are expected to do so in the Fall semester.

For purposes of comparison I will list now the data on a CIS 114 delivered in the normal face-to-face mode, with no EIES and no Video support. This section was given in Fall 1993, at the same time as CIS 114-451 mentioned above. It's number is CIS 114-001. This class was registered by 33 students. Of these 33 students, 19 dropped the class, which is

unprecedentedly high, even for a difficult class such as 114. In my estimate, a "normal" drop out rate for 114 is about 40%. To the surviving students, the following grades were given: A (5), B+, B (2), C (3), D, F (2).
In the balance of this report I will discuss experiences made during those three sections, concentrating on the Spring 1994 ``normal speed'' class, but making comparisons whenever it seems appropriate.

CIS 114 in the Virtual Classroom

The basic format of CIS 114 in the Virtual Classroom was as follows. Students were required to sign onto their computer at least twice a week, preferably after seeing the appropriate three video tapes of the week, and after reading the corresponding book chapter. (Of course, there was no good way for me to verify this.) I would post three questions every week, on the material of the chapter, and students were required to supply answers within four days. I repeatedly pointed out to them, that the three questions would NOT cover all the material of the chapter. Rather, these questions stressed important topics, pointed out the expected depth of study, and prepared the students for possible question formats at their exams.

Some of the questions were posted as simple conference comments, but most of them were posted as ``activities.'' An activity is a posting for which a student has to post a reply before he can see the replies of the other students in the class. Students were also asked to comment electronically on at least one posting of another student within the two days after the first weekly due date. This posting could be a criticism, a correction, or even a question for clarification.

In addition to these requirements (``interaction homeworks'') students also had to mail in printouts of three programming assignments. The assignments themselves were posted on the EIES system. Midterm and final exam were given in class. Even though the Distance Learning Center and the Project Director permit the use of proctors for exams, I consider this detrimental to the reputation of the Virtual Classroom, and I insisted on being personally present during the exams. As none of the students was from outside of the three state area (New York, New Jersey, Pennsylvania), this requirement did not place an undue burden on the students. In fact, most of the students appeared to be within about an hour driving distance from NJIT.

During the Spring of 1993, two situations occurred, over which nobody at NJIT had any control, and which caused some problems. The first problem was an uncommonly cold winter, with an immense amount of precipitation. This lead to several snow closings of the University and, interestingly, to the fact that the Virtual Classroom courses were almost entirely on schedule, while most other classes were limping behind. Still, individual students were hampered in their class contributions.

The second problem was with the company in charge of tape delivery, which did not perform very well. Several students had not received their tapes well into the semester, and the Distance Learning Center was forced to switch supplier in the midst of the semester. Some students were very vocal about this problem, one of them going all the way up to the president. In response to this complaint, the administration of NJIT extended the semester for all affected students by about two weeks.

While this decision was in the best interest for the students, it created a number of administrative problems. It did not seem fair to extend the semester only for the ``complainers,'' and it was also difficult to retroactively verify who had had problems with tape delivery (and/or snow!). Therefore, I was forced to offer the semester extension to all students. All but two students of the ``normal speed'' section, and all students of the double speed section took advantage of this extension. Due to this fact, the double speed section was not really a double speed section, and students had more time than they themselves expected for the last programming assignment and final preparation.

Experience Report after Teaching CIS 114 Three Times Online

----

1) Problems

(a) Problems with Regular Login

Instructors were prepared by project group discussions and by their own experiences as students and teachers, that both, the most crucial and most difficult problem would be to enforce the weekly login schedule of all students. In practice it was found quickly that only a minority of the students in all three sections kept completely to the schedule. However, the problems and reasons for not doing so were surprisingly varied.

* Hardware problems. One student did not sign on during the first two weeks of the class, so I phoned him at home. He described to me that his computer was right now in many little pieces on his desk. He could not afford to have it professionally repaired, and the chips that he needed for a self repair had not been available to him for some time. He eventually managed to sign on and catch up with most of the class.

* Erratic schedules due to jobs. One student had a software release emergency in his job. Due to that fact he asked for extensions of the online assignments. I should note that I was very generous in such extensions, far more generous than in any face-to-face class I had ever taught. The student was able to catch up ``mostly,'' but some of the answers were obviously done in a hurry, and they did not deserve full (or not even partial) credit.

* Erratic schedules due to family ``problems''. One of the students was a Medical Doctor, who took the course for his personal enrichment. He did very well during the first several weeks. (As a side note, it would have made me rather uncomfortable had I received any ``stupid'' answers from this student, but luckily this was not the case. I guess we can trust in the MD education.) However, before the middle of the semester, a daughter was born to the doctor, and he withdrew from the class after trying to keep up for a little while. Obviously, he was not in a do or die situation, he has a degree and a job, so he could afford to drop the class.

* Initial discouragement due to software problems. Some students seemed to have initial problems with the system. Several students reported to me that they were logged out by the system in the middle of their sessions. In some cases, this seems to have created discouragement and delay. Although I can be trusted to have used the system more often than all my students during these two semesters, it happened to me only once or twice that I was

disconnected by the system. However, the reports of the students cannot be disqualified as exaggerations, as my computer/modem is in the same local calling area as NJIT, while many of the students had to make toll calls.

* Just not accepting the facts. Unfortunately, there was at least one student who either ``just did not get it'' or did not want to understand that he was required to do work on a weekly basis. Writing a student a note that he has to read the questions on the system does not help a lot if he does not read/remember/accept the note in the first place.

(b) Problems with Filing Away Information

It became very clear during this course, that students had difficulties with filing away information for later use. ``File away'' can be done either mentally, or physically, by saving information in a private conference, and referring back to it. This is a problem that also occurs in face-to-face classes. Nevertheless, for the teacher it seems more acceptable if a student just forgets something that he heard (or possibly did not hear) than if a student does not remember something that he (claims he) read and that still exists in writing on the system.

This problem occurred specifically for late penalties. Those were posted on the system, but students still came back and asked questions about them. My generalization of this and similar experiences is that online information should be given in small portions and as near as possible to the time of use. Fairness dictates that late penalties be announced at the beginning of the semester or with a project assignment, but (for some students) they better be repeated on the day before the due date. Similarly, announcing an exam date four weeks or longer before the exam is necessary to let students schedule rides, baby sitters, or whatever they need. Still, three days before the exam a reminder is essential.

Roxanne Hiltz, the project director of the Virtual Classroom, has suggested that a possibly way to improve the ability of the students to file away information on the system would be to spend more time during the face-to-face orientation, explaining how to use features such as keyword search.

(c) Problems with getting a discussion going

In project group discussions, the importance of starting interactive discussions with the students and between the students was repeatedly stressed. By specifically requiring a comment on another student's posting, and by grading this comment, I tried to achieve this ideal, but by and large I must admit failure. Some students posted comments some times. Many students never posted any comments, and nobody got full credit on this component of the course. My repeated reminders and requests did not help.

After thinking about the problems, there seem to be four sources for this difficulty:

(1) Algorithms and complexities of algorithms are not up to discussion. You know them, or you don't. There is very little to discuss. Most of the questions that could be raised in a discussion would be either research issues at the "upper end" or the discussion is a result of insufficient study of the material at the "lower end". In the latter case, the students are well aware of the problem and therefore not comfortable with being involved in a discussion that shows they don't know some material.

(2) The pressure in this course is considerable. It takes most people a long time to understand the intricate data movements of Quicksort or Insertion Sort. The programming assignments are also difficult. Students make the reasonable decision that they better answer the required questions and debug their programs before they afford the luxury of a discussion.

(3) Possible there is a third problem that is due to the teacher. I was educated in Austria until age 24. Austria has what I would call a German system of education: The professor lectures and the students listen and take notes. Few students dare to ask questions in a lecture hall with 200-1,500 (!) students. Most of them are not up to the point of asking questions, and professors by and large do not encourage the asking of questions, especially in these large sections. (There are some smaller recitations and seminars also.)

(4) Students seem afraid to critique a classmate's postings, because they are afraid they will cause a lower grade for a fellow student.

(2) Lessons Learned

* The Conferencing System is Essential The use of "activities" that permit communication but make cheating impossible is an essential tool in running the Virtual Classroom. In fact, I was approached by students who were worried that other students would just copy their own postings without investing the same amount of time and effort. The use of activities was very comforting for them.
* The good do well. It appears that students that are doing well in general are doing well in the Virtual Classroom, too. Unfortunately, it is hard to supply enough observations to support this lesson, as my personal interaction with most students was extremely limited. It might be interesting to collect complete grade profiles for all students in the VC program, to substantiate this observation.
* Self-discipline is a good indicator for success. The Virtual Classroom appears to be ideal for disciplined students. Again, this is a personal impression that is hard to quantify or even justify. Maybe we could collect data by interviewing previous teachers of students attending the Virtual Classroom. To avoid biases, the interviewing should be done by people not instructing the respective students.
* Face-to-face orientation on EIES boosts survival rates. The most important improvement between the Fall 1993 class and the Spring 1994 classes was the scheduling of a face-to-face orientation in a computer lab, where students were shown the actual EIES system. I attribute much of the improved results between those two semesters to this orientation session. This session took only two hours and was NOT hands-on, except for the instructor, but by projecting the EIES screens onto the wall the ideas came across very well. * New ideas on getting a discussion going. During a project group meeting near the end of the Spring 94 semester, I picked up an improved approach that could help me getting an online discussion going: When a students posts a wrong answer, ask another student (by name) whether he can correct the answer, and give a hint what the problem is. I had previously avoided to "call on a student by name" because I wanted to avoid potential embarrassment. However, in an asynchronous medium such as EIES, the student has sufficient time to prepare his answer and avoid an embarrassment. I had carried over a habit from face-to-face classes to virtual classes which appears overly cautious.

* More ideas on getting a discussion going, suggested by the Project Director. Students could be required to post at least one message every week, that is not related to a homework assignment. It might be related to the course, but it might be more general. For instance, students might have read something in a news paper that appears relevant to the topics of the class.
* Scheduling of questions can be optimized. Students asked me to enter questions and set due dates so that they have at least one weekend in between. This is a very reasonable request (at least for the ``normal speed'' class) but I missed doing this.
* Scheduling of broadcasts can be optimized Students, even remote students, want to take off for Spring Break. My initial schedule did not allow for that, because the cable TV broadcast schedule did not allow for it either. I have already requested from Distance Learning to schedule a "rerun" for the week of Spring Break.

(3) Assorted Observations ------------------------

* The original intention of the double speed section was to cover exactly as much material as in the normal speed section. In reality, the pressure was too big for the students and the instructor, and I settled for dropping one programming assignment and the midterm.

In the middle of the double speed class, students were asked whether they would prefer a midterm and a non-comprehensive final, or no midterm and a comprehensive final instead. The students voted against the midterm. One student pointed out that the programming assignment interfered with study time for the midterm. The bottom line is that programming is such an intensive activity that one cannot assume that it can be done in double speed. Numerous ``all-nighters'' that almost all successful CS students seem to have gone through, support this claim.

* It is sad that during the previously mentioned two hour orientation the car of one of the students was stolen. (It was recovered with very minor damage a few days later). As somebody drily remarked, ``Now I see another advantage of distance learning: I don't have to come to Newark by car.''

The Main Differences between VC and f2f --------------------------------------

* Many students sit through traditional lectures and don't seem to understand many of the ideas. Still, they apparently pick up enough terminology and ideas that they can prepare from their notes and books for a passing midterm grade. In distance learning as we are doing it, students are forced to understand difficult ideas every week, or they won't be able to answer (my) weekly questions. This investment pays off at exam time, where they already know the material and don't have to study much more. It would be an interesting empirical question whether those students will be better in the long run, because they spread the learning over a longer period of time, limiting cognitive interference.
* As a teacher I feel that if I am lecturing the same material several times, I am getting better and better at it. As I am not lecturing during distance learning, I am concerned whether this improvement effect still exists. This question might also be interesting for empirical research, although difficult to answer due to small sample sizes.
* In traditional classes, the number of students that are attending a class is almost irrelevant, except for the time it takes to grade exams. (My programs are graded by TA's.) In the Virtual Classroom, every student adds a load, and I would keep class sizes at maximally 12, if that were economically feasible.

A Personal Conclusion

Without claiming any scientific support for the following statements, it appears to me that the Virtual Classroom is an ideal learning tool for students who are highly motivated and/or have a large amount of self-discipline, AND additionally have some previous knowledge of EIES or another conferencing system. My recommendation for a distance learning curriculum of study is therefore to teach the first year, or at least the first semester, in a face-to-face mode. During this time students would get fluent in using EIES and a primary programming language such as PASCAL or C++. Then they will be successful in the remaining completely virtual course of studies.

Machine and Assembly Language Programming: CIS-231

Video plus Virtual Classroom Course

Spring 1994
Ajaz R. Rana
August 18, 1994

1 Introduction

This report is a result of a research grant from the Afred Sloan Foundation to Roxanne Hiltz of Computer and Information Science Department at NJIT. The objectives of the project include experimenting with the creation of a "21st century" model for computer-supported learning. This model uses computer mediated communication systems to allow class members to participate in the coursework at whatever times and places are most convenient for them.

Like any other course, various approaches were possible to cover the course material. I adopted an approach which enables students to to start writing programs at an earlier stage in the semester. It is argued that using I/O macros is not essential and the debugger is enough for students to submit their program output. I devoted ample time to teaching the debugger. But I also included some I/O macros. The I/O macros used in this course force the students to master the conversion between `character', `packed decimal', and `integer' data types. Several programming homework assignments required students to carry out conversions between data types. In my opinion, this conversion process allows the students to understand an important concept which is not easily conveyed in high level language courses.

This report includes a brief account of my experiences (both positive and negative) as an instructor for Machine and Assembly Language Programming (CIS231). In the Spring of 1994 I taught two sections of CIS231, one in traditional Face-to-Face (FtF) mode, and the other in VC-plus-video (distance) mode. Students from both sections were added to the same conference on EIES2. A diskette of lectures and homework assignments is aslo included in this report.

The report is organized as follows:

- o Problems Encountered.
- o Joys of Teaching Online.
- o Answering Students' Questions.
- o Feedback from Students.

2 Problems Encountered

2.1 Establishing Student Accounts on Two Systems:

This course required that students use two systems: (1) EIES/VC, and (2) TESLA (a VAX/VMS system at NJIT). All courses using EIES in the Spring of 1994 experienced problems with getting their accounts activated in a timely manner. The reason for this were delays in mail delivery to students, and back from students to the University; also procrastination on the part of students in returning the account application forms.

I suspected that students would come to the orientation session without having a valid, active account on EIES and the training session would not meet its objectives. In anticipation of the above problems I had acquired some ac-
counts for my class an evening before the scheduled time for the training session (Saturday morning!). Special thanks to Eileen Michie, Pete Tekilinski, James Whitescarver and Tom Terry for help in this matter. Upon my insistance, Eileen
and Pete both worked from their homes to make an exception to the policy and had the accounts ready. So the EIES accounts were really not a problem for my distance section. However, I did experience problems in making sure that FtF
students follow the account acquisition procedures.

Getting TESLA accounts for distance students was also a challenge. A welcome letter to distance students included an application form for TESLA accounts. Students were to fill out and return the application forms, which I had to bring to Computing Services Department (CSD). CSD promises a 24 hour turn around time. Once CSD had done its job I had to inform distance students that their accounts are ready. Responding to students inquiries about the readiness of their accounts was extermely distracting.

2.2 Training:

Besides the planned training/orientation session, I had to conduct several individualized sessions to acquaint students with EIES. In spite of the unpleasant personal consequences of the wasted time in individualized training sessions, I take pride in making myself available to the students at their convenience and I did observe gains in student interest in the course.

2.3 Delays in Tape Delivery:

Intolerable delays in tape delivery (especially in the earlier part of the term) was the most disturbing aspect of my teaching experience in video-plus-vc mode. The biggest factor contributing to the delay was that my lectures had to be video recorded, dubbed, and mailed to the students. Closing of school due to heavy snows and the UPS strike in the Spring of 1994 made things worse. I had to make several phone calls and personal visits to the Distance Learning Department to get statuses on tape mailing and keep the distance learners informed. However, I must add that I am greatly thankful to Ann Lippel and Dale Munn for their efforts to respond to my repeated requests and take action to resolve the problems that were out of their control. I am also grateful to Roxanne Hiltz for approving extra money to improve the process of tape copying and mailing.

2.4 Hardware and Software:

It is unfortunate that the "Assembly and Machine Language" course is based on an architecture that is incompatible with the architecture on which EIES runs. This incompatibality caused severe problems for students in E-mailing the programming homework. Students did their programming projects on TESLA and either downloaded and then uploaded them to EIES or E-mailed them directly to me via the Internet. During the semester, the Internet mail feature of EIES was not stable. I had to have my Internet mail redirected to another system. This redirection introduced delays and a lack of immediate acknowledgement to the students about the receipt of their their homework.

No matter what mode is used, the submission of homework remains a serious hurdle. Students want an acknowledgement of the receipt of their homework. Downloading and uploading of homework is an inconvinient process on EIES even at its best.

Besides a couple of instances of items being lost, I had no major problems with EIES. As always, EIES staff was very helpful to both me and students.

2.5 Course Preparation:

Teaching this course online for the first time and video recording simultaneously required very different kinds of preparation. Making the PowerPoint slides for 2 presentations per week and later converting them to a comprehensible ASCII format for uploading to VC was a time consuming process.

Due to the lack of laser printers attached to the PCs, every PowerPoint presentation had to be converted to postscript format, uploaded to one of the departmental machines, and then printed. However, I must thank Dr. Peter Ng, chairperson CIS, for supporting my efforts and acquiring a new PC for me.

2.6 Providing Feedback:

I was used to correcting homework by putting a lot of red ink on hard copy submissions. Upon consulting with other faculty members who had more experience of teaching via this medium, I decided to do the following: (1) take a hard copy of student responses; (2) correct/grade them as usual; (3) post students' grades using the `grade book' activity; and select and post one of the best responses in the class conference for others to see. A better approach would have been to append/insert my comments to individual homework and then E-mail each homework back to students. However, time constraints did not allow me to adopt this approach.

3 Joys of Teaching Online:

3.1 VC a Place for Cogitative Discussions:

In my opinion, one of the strongest points of teaching and learning in a Virtual Classroom (VC)1 is that the instructor and the students can engage in a discussion that requires intense thinking. In other words, given a problem, instructor and students can problem solve, and discuss different approaches to solving a problem. Moreover, they can problem solve with a greater participation from the participants. Not to say that such an activity is not possible in a traditional classroom, but that it is time inefficient. In VC the participants can work on a problem in a parallel mode and present their solutions for others to reflect upon.

Following is an example discussion that started in my class during the second week. Generally the beginning weeks of this class are of introductory nature and are focused on building the foundations for the material to be covered in the later weeks. When I initiated the discussion question none of the distance students had received the video tapes. However, I had been encouraging students to read and ask questions. I think, that the discussion in VC mode enabled
greater participation than would have been possible in a face-to-face class. Additionally, those who participated had the time and opportunity to think, read, and then respond.

C 2134.4 CC 21 Ajaz R. Rana (Rana,2134) 1/31/94 10:57 AM 64 lines
KEYS: Lecture 3 Subject: Lecture No. 3 R: 4/12
+--+

In lecture three I reviewd the conversion between binary and hexadecimal number systems. The technique is very simple.
Each four-bit binary number corresponds to one hexadecimal digit. Hexadecimal digits and their binary equivalents are:

hex	binary	decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

The main topic of the third session was binary arithmetic and integer representation.

I showed several examples of binary and hexadecimal addition and subtraction. For beginners I recommend doing the multiplication and division by converting to decimal system.
Integer representation would be simple if we did not have to deal with negative integers. Three mechanisms were discussed:

1. Sign-magnitude representation
2. One's complement representation
2. Two's complement representation

By taking examples I highlighted the drawbacks of sign-magnitude and one's complement representation. VAX uses two's complement. It is important the two's complement arithmetic, along with the concept of overflow, be understood very well. In order to practice these concepts try the exercises given at the end of Chapter 3. Note that you can verify the answers of odd numbered problems, the answers are given in an appendix. In a separate comment I'll assign some exercises as homework to be submitted.

For discussion purposes I would like you to volunteer and answer the following two questions:

> In two's complement representation
> What are the largest negative and positive numbers that can be stored in a byte, word, and longword ?

> There is an integer that can be represented in two's complement form using eight bits but whose negative cannot. What is this integer?

I realize that, at this point distance students are at a disadvantage due to delay in tape delivery, but I encourage you to read the text and ask questions here.

C 2134.4 CC 30 Ajaz R. Rana (Rana,2134) 2/2/94 12:07 PM 20 lines
Subject: Raise you hands
+---+

Soon I'll post a summary of lecture 4. In the comment related to lecture 3 (see comment number 21), I had asked you to discuss some questions. No one has replied to it yet.

I know that the tape delivery to distance students is delayed. But this should not stop you from reading the text and asking questions if you have any confusions. The distance students must have received the lecture material on most of the topics covered in lecture 1, 2, and 3. By Friday I'll have part of lecture 3, 4, and 5 surface mailed to the distance students.

Please keep up with the readings and ask or answer questions here. Sign-on regularly.

I am waiting for your response on discussion questions on lecture 3. If you feel you don't know the answer say so and I'll explain it.

C 2134.4 CC 21.1 Rhonda L Williamson (Booboo,11072) 2/2/94 3:40 PM
27 lines Subject: Lecture No. 3 R: 2/3

This is in response to lecture #3's Discussion questions.

The first question asked about the longest integer that can be stored in a byte, word and longword. If you don't take negatives into account that would be 255, 65535, and 4,294,967,295, respectively.

If you take negatives into account, you have to leave the most significant bit for the sign. So the largest positive and negative numbers you could represent would be 127 (0111 1111), -127 (1111 1111), 32,767 (0111 1111 1111 1111) and -32,767 (1111 1111 1111 1111), 2,147,483,647 (0111 1111 1111 1111 1111 1111 1111 1111) and -2,147,483,647 (1111 1111 1111 1111 1111 1111 1111 1111).

The second question was what integer could be stored in eight bits whose negative can't using two's compliment. The only integer I can think of would be 0. It would be represented as 0000 0000.
If you took it's two's compliment, you would have 1111 1111 + 1 or 1 0000 0000.

Did anybody else out there come up with these results? How about something different? I would like to have some feed back to see if my thinking is correct.
Rhonda

C 2134.4 CC 21.1.1 (ANONYMOUS) 2/4/94 12:21 PM 6 lines R: 1/1
KEYS: DISCUSS QUETIONS RHONDA Subject: DISCUSS QUESTIONS
+---+

RHONDA
I HAD THE SAME ANSWER AS YOURS. YOU SAID ONLY ZERO COMES TO YOUR MIND.
WELL IT IS ONLY THAT CANNOT HAVE A NEGATIVE. IF IT HAD THEN THE WHOLE CONCEPT
OF REPRESENTATIONS IN 2's COMPLEMENT METHOD WOULD HAVE A DRAWBACK SAME
AS THAT OF 1's COMPLEMENT.
..........YASH,11139

C 2134.4 CC 21.1.1.1 Ajaz R. Rana (Rana,2134) 2/4/94 6:55 PM 6 lines
Subject: DISCUSS QUESTIONS
+--+

Yash,

Please answer YES to the question USE NORMAL SIGNATURE before sending a commnet. This way your response will not be anonymous. It seems that it was a typing error, because you did identify yourslef in the comment.

C 2134.4 CC 21.1.2 Ajaz R. Rana (Rana,2134) 2/4/94 6:50 PM 48 lines
Subject: Lecture No. 3
+--+

Good job, Rohnda.

Your thinking is correct and logical. The distinction you made between positive and negative (signed and signed) tells me that you understand the nature of the problem.

The purpose of me raising this question was to point out something about these ranges which could be argued as not so logical.

The ranges you gave us for UNSIGNED numbers are correct, which are:

Byte: 0 to 255
Word: 0 to 65,535
Long: 0 to 4,294,967,295

But, the ranges for SIGNED two's complement need revision. First let me say that I would not give the right answer at this point and wait for others to take a shot. However, I must point out that the binary representations of largest negative numbers you showed don't seem right.

You noted as follows:

Size   Binary representation of largest
        negative number:

---- --------------------------------

Byte: 1111 1111   -127 (in decimal)

Word: 1111 1111 1111 1111   -327,67 (in decimal)

Long: 1111 1111 1111 1111 1111 1111 1111 1111
  (I forget the decimal number you noted for this.)

Think about it, -127 in two's complement is:

1000 0001, and not
1111 1111
In two's complement 1111 1111 represents
-1 (negative one decimal)

Same goes for 1111 1111 1111 1111, and
1111 1111 1111 1111 1111 1111 1111 1111

The answer to the second question follows from the first and I'll hold on to my response.

C 2134.4 CC 21.2 UdayaRani Mukunda (Udaya,11098) 2/3/94 1:46 PM R: 2/2
12 lines Subject: Solutions for Lect 3 Discussions
Modified on 2/7/94 5:38 PM by UdayaRani Mukunda (Udaya,11098)
+--+

The first answer is :

Byte   : +127 , -128
Word   : +32767 , -32768
Longword : 7FFFFFFF, 80000000

The second answer is :

I dont know weather I am correct, but, we can repersent -128 using 8 bits and cannot represent +128.

C 2134.4 CC 21.2.1 Ajaz R. Rana (Rana,2134) 2/4/94 7:06 PM 15 lines
Subject: Solutions for Lect 3 Discussions
+--+

Response to first answer by Udya:

Udya, if I remeber correctly I had asked what are the largest and smallest two's complement integer, not just largest (i.e, positive). It's the smallest (i.e., negative) integer that makes the problem not so intuitive.

Response to second answer by Udya:

You are right in saying that the integer we are looking for is not 0 (zer) but I don't agree that there is no such integer.

C 2134.4 CC 21.3 2/3/94 2:15 PM 10 lines Subject: replt in no. 3
richard mallet rutg stnt 11101 (richard mallet rutg stnt 11101,11101)
R: 1/1
+--+

byte :FFFF FFFF
word :FFFF FFFF FFFF FFFF
longword :FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF

The integer is 0000 0000 because,

```
 1111 1111
        +1
----------
10000 0000 submitted by Rich Mallet
```

C 2134.4 CC 21.3.1 Ajaz R. Rana (Rana,2134) 2/4/94 7:10 PM 4 lines
Subject: replt in no. 3
+--+

Rich, its not zero, as you showed us, if we discard the carry then +0 and -0 are the same.

I am tempted to give the answer but, I'll wait.

C 2134.4 CC 21.4 padma ganti (padma,11505) 2/4/94 6:06 PM 13 lines
KEYS: Questions Subject: Discussion R: 1/2
+--+

My solns. to the two questions in Lecture 3 are the same asthe others.
Largest integer in byte = 0111 1111 / 7F / +127
It's negative in two's compl. =1000 0001 / 81 / -127
In word , 0111 1111 1111 1111 / 7FFF / + 32,767
It's -ve is 1000 0000 0000 0001 / 8001 / - 32,767
In longword , 0111 1111 1111 1111 1111 1111 1111 1111 /
7FFFFF/ +2147483647
It's -ve is 1000 0000 0000 0000 0000 0000 0000 0001 /
80000001 / -2147483647
I'm not able to find soln. to the 2nd question. It'0 or -128 as prby others. It is an integer to ose complement if 1 is added , overflow may occur. How do we figure it out ?

C 2134.4 CC 21.4.1 Ajaz R. Rana (Rana,2134) 2/4/94 7:19 PM 10 lines
Subject: Discussion R: 1/1
+--+

Padma,

You did show us the correct binary representations of -127, 32726, etc.

Your guess about the second question is also right

-128

Let me read others' responses, may be someone has explained it.

C 2134.4 CC 21.4.1.1 padma ganti (padma,11505) 2/5/94 6:18 AM 9 lines
Modified on 2/5/94 6:38 AM by padma ganti (padma,11505)
A: C 2134.4 CC 21.4.1 Subject: Discussion

Prof. ,
I've figured out on , just now that Robin is perfectly right in his answer -128 for the 2nd Qn. and that my answers for largest -ve inis screwed up. I signed on to modify my responses and found you and Robin've already beaten me to it. Early mornings do clear up my bit.

I got my first tape (Lect.1,2,3) 2 days ago. Is my answer to item 10 in exercise 3.4 in text OK ? What about providing solns. for th?

C 2134.4 CC 33 2/3/94 1:03 PM 13 lines KEYS: rich reply
richard mallet rutg stnt 11101 (richard mallet rutg stnt 11101,11101)
+---+

1. the largest postive #'s to be stored in:
byte: FFFF FFFF
word: FFFF FFFF FFFF FFFF
longword: FFFF FFFF FFFF FFFF

2. The integer is probably 0000 0000 because

```
           0000 0000
complement 1111 1111
                  +1
         ---------
         11111 1110
```

by Richard Mallet

C 2134.4 CC 38 Robin S. Tanenbaum (Robin,11023) 2/4/94 11:51 AM R: 3/6
30 lines KEYS: Chapter 3 Discussion Subject: Chapter 3 Discussion

Hi, everyone! AT&T is going to love my taking this distance learning class. If you don't hear from me next month it's because I had to pawn my computer to pay the telephone bill.

Anyway, how about this for an answer to the question of which 8 bit integer can be represented in two's complement form, whose negative cannot:

-128 is represented in two's complement as 1000 0000

```
(take the complement:  0111 1111
add 1:                +        1
                      ----------
result                 1000 0000
```

this is 128 in decimal, but remember, it's negative, so we have -128

+128 which is, after all, the negative of negative 128, can not be represented in 8 bits in two's complement notation. The binary equivalent of 128 is 1000 0000. In two's complement notation, this is a negative number. The largest positive number that can be represented in 8 bits in two's complement notation is 0111 1111 which is 127.

So our answer would be -128 which, in two's complement binary, is 1000 0000.

- Robin

C 2134.4 CC 38.2 padma ganti (padma,11505) 2/4/94 4:51 PM 6 lines
Subject: Chapter 3 Discussion R: 1/2
+--+

Hi Robin,
In two'cot representation, like in other two methods, the leftmost bit is the sign bit, 0 means -ve and 1 means +ve .So, will -128 be 1000in two's complement ?
Thank you for resolve doubt in 'Why Hex' para.

C 2134.4 CC 38.2.1 Robin S. Tanenbaum (Robin,11023) 2/4/94 6:03 PM 7 lines

Subject: Chapter 3 Discussion R: 1/1

+---+

Padma,

I think you've got it reversed. A 1 in the leftmost bit indicates a negative number (see the representation of -92 on page 31 of the text), while a 0 signifies a positive number. I think 1000 0000 indicates -128, but I coul
d be wrong. Does anyone else have an opinion?

Robin

C 2134.4 CC 38.2.1.1 Ajaz R. Rana (Rana,2134) 2/4/94 7:22 PM 7 lines

Subject: Chapter 3 Discussion

+---+

Robin, you are absolutely right.

1000 000 is -128

Now, everyone think about the ranges for byte, word, and longword.

C 2134.4 CC 38.3 Ajaz R. Rana (Rana,2134) 2/4/94 7:49 PM 12 lines

Subject: YOU GOT IT

+---+

Thats correct. You explained it very well, thank you.

At this point I shall not summarize the discussion on the smallest and largest two's complement numbers and would like to see those who did not get a chance to respond make sense out of the discussion so far.

If anyone understands the issue clearly, feel free to summarize the conclusion.

Remeber, if there are any confusions RAISE YOUR HAND.

C 2134.4 CC 21.2.2 Ajaz R. Rana (Rana,2134) 2/9/94 3:14 PM 2 lines
Subject: Solutions for Lect 3 Discussions
+--+

Your summary is correct, thanks. Everyone please make a note of it.

C 2134.4 CC 80 Sandeep D. Furia (Sandy,11068) 2/18/94 12:25 PM R: 1/1
41 lines KEYS: Discussion Subject: Reply to discussion in Lect. 3
+--+

I know this is kind of late to reply for the discussion question from lecture 3. Actually I wasn't even aware of the question until Prof. Rana mentioned it in class on Tuesday and then he also gave the solution to the first

part of the discussion which many got right. So I guess that it's my fault I wasn't at par with the you guys. But I think I'll still post an answer to the discussion question since I have some doubts about the second part.

The answer to the first discussion question is,

Byte: -2^8 < 0 < 2^8 - 1
Word: -2^16 < 0 < 2^16 -1
Longword: -2^32 < 0 < 2^32 - 1

So in general if we have n bits then the range of representation in the two's complement form is,

-2^n < 0 < 2^n - 1

Now as to the second part many of you guys gave the answer as -128 which was very much approved by Prof. Rana and there is no way I can contradict him. But still if you read the question once more you would notice that what Prof. Rana was asking for was a positive number whose negative cannot be represented by 2's complement. So if his question were other way round then -128 is as

good as a mountain.

Now in response to his original question, in my belief no such number exists because you will notice from what I mentioned above that the largest negative number is one more than the largest positive number which can be represented by 2's complement form.

And this is for all you scholars like me (a donkey always praises his tail) the answer is in no way -129 because in algebra -129 < -128 but in computer science it is not so. And in my view this is an important point to not ice because we always say "largest" negative number and not the "smallest" negative number.

Well I guess that's about all I had to say.
Thank You.
Chao.

N.B. : I would appreciate it if you would reply back to my comment and tell me what you felt about my ideas. Obliged.

C 2134.4 CC 80.1 Ajaz R. Rana (Rana,2134) 2/19/94 6:17 AM 6 lines
Subject: Reply to discussion in Lect. 3
+---+

Sandeep,

My original question was not what POSITIVE number, but simply as stated by the author of your text on page 35 as exercise 16.

3.2 Students Teaching their Fellow Students:

I had read and heard about collaborative learning (Harasim et al, 1994)2 but had never before experienced or realized its benefits as an instructor. It was a pleasure to observe students helping and teaching each other. Following is an episode that refelects upon the power of this medium to allow collaborative learning. It should be noted that the problem being discussed by the students in these comments is not a homework problem. Students worked on, and discussed these problems on their own initiative. Can undergraduate students be better than that! I am proud to have had these students in my class.

2Harasim H., Hiltz R., Teles L., & Turoff M. (1994) Learning Networks: A Field Guide,
Cambridge: MIT Press.

C 2134.4 CC 98 padma ganti (padma,11505) 2/26/94 2:47 PM 11 lines
KEYS: Question, Thanks Subject: Ex.19,Ch.5 R: 1/6

Hi Rana,

Regarding Ex.19 , Ch.5 at the end of the chapter, I could not run the program successfully. It's similar to the textbook answer since I referred to it as I worked it out. But when I tried to print the message I only got upto 'Hel lo, Padma G'. The machine instruction format ivery much tha same as the text's answer. Please dvise. Did anyone else find the same thing ?

Thank you for the clarifications on Exercises Ch.4 I've yet to look in detail. I got 2 more tapes yesterday. They would be Lectures 7 "& 8, I guess

.

Ganti

C 2134.4 CC 98.1 Robin S. Tanenbaum (Robin,11023) 2/27/94 9:37 AM
6 lines Subject: Ex.19,Ch.5 R: 1/5
+---+

Padma,

Perhaps if we could take a look at your code we could help figure out why most of your last name is being cut off. Any chance you could send the code over from TESLA, or, if it isn't too long, just type it into the conference?

- Robin

C 2134.4 CC 98.1.1 padma ganti (padma,11505) 2/27/94 3:31 PM 9 lines
Subject: Ex.19,Ch.5 R: 4/4
+--+

Hi Robin,

I've assembled and run the program given as answer to Ex.19 in the textbook. I typed in the source program as it is , exactly. Yet, in the output , my last name was just 'G' . Did you try that and see ? Maybe there is an error .I
based my program on the reasoning provided there.

As for the answer to Ex 19 Ch 4, from Mr Rana's response, it appears to me there is more to it than that.

Padma

C 2134.4 CC 98.1.1.1 Robin S. Tanenbaum (Robin,11023) 2/27/94 4:29 PM 13 lines
KEYS: Ex. 20, Ch. 4 Subject: Ex. 20, Ch. 4 R: 1/2
+---+

Hi, Padma. I'll try the name program as you suggested and see what I get.
What do you think about this as the answer to question 20?

```
location counter     instruction
----------------     -----------
00000628             alpha:  .long  1024,5000
00000630             beta:   .blkw  3
00000636             tag:    .byte  1
00000637             label:  .ascii /vax/
0000063A             gamma:  .blkw  6
00000646      FINAL VALUE OF LOCATION COUNTER
```

- Robin

C 2134.4 CC 98.1.1.2 Ajaz R. Rana (Rana,2134) 2/27/94 7:24 PM 6 lines
Reply to : C 2134.4 CC 98.1.1.1 Subject: Ex. 20, Ch. 5
+--+

Robin,

Your answer to chapter 4, exercise 20 is correct.

In the subject heading and keys for your message you said
Chapter 5, Exercise 20. Please correct it.

C 2134.4 CC 98.1.1.3 Ajaz R. Rana (Rana,2134) 2/27/94 8:14 PM
20 lines Subject: Ex.19,Ch.5
+---+

I quickly looked at the answer to Exercise 19 chapter 5, that Ganti had tried. I did find a mistake in it. Since Robin said that she is working on it, I'll hold on and not give the answer.

But let me give you a hint, after the instruction

```
MOVC3 R6, BUFFER, (R7)
```

but before

```
INCL    R7
```

We need to increment R7 by the size of LASTNAM, Now try to see which register has this information and how would you fix it.

Good luck.

I hope all of you understand why I don't give the answer so quickly. Believe me I am not being mean.

C 2134.4 CC 98.1.1.4 padma ganti (padma,11505) 2/28/94 3:30 PM 7 lines
Reply to : C 2134.4 CC 98.1.1.1 Subject: Ex. 20, Ch. 4
+---+

Robin,
In Ex.20,Ch.4, the first directive initialises a gword. So it stores 4 bytes.Therefore, BETA = 0000 0632.

Finally, . = 0000 0648

When adding , midway, I did as if they were decimal no.s, didn't I ? That's how I got what I did.

C 2134.4 CC 99.1.1 padma ganti (padma,11505) 2/28/94 2:40 PM 14 lines
Modified on 2/28/94 3:40 PM by padma ganti (padma,11505)
KEYS: Hwk.5,Ex.19 Subject: Hwk 5,Ex.19. Ch.4 & 5

+--+

Rana,

I took your advice and was able to complete the assignment. I found the same thing as Robin observed , that the output format is as it suld be when I said 'type .out ' file , but when I said 'type .mar' , the output at the end of the appended files is different.

There're two blank lines in between , instead of one.

I thought my answer to Ex.19, Ch.4 was'nt rig, reading your response t. As for Ex.19, Ch.5 , after I wrote the program for Homework 5, I felt confident enough to tackle it again. Then I read Robin's answer .It was what I thought. I've altered accordingly and successfully run the program.

Ganti

P.S. It was me who entered cc 90.1.1, 9 on 2/24. I saw that they disappeared. So I did them again in 90.2.2.

C 2134.4 CC 104 Robin S. Tanenbaum (Robin,11023) 2/28/94 12:39 PM
64 lines
KEYS: Chapter 5, problem 19 Subject: Chapter 5, problem 19 R: 2/2

+---+

Padma,

The program in Chapter 5, problem 19 will execute properly if you make the following change:

delete INCL R7

replace it with ADDL2 R6,R7

This is what the program was doing:

```
MOVAB   OUTLINE,R7      put the address of OUTLINE in R7
ADDL2   R0,R7           added the length of your first name
                        to the address in R7. Now R7 points
                        to the space after your first name
                        in OUTLINE
MOVB    #SPACE,(R7)+    puts a space in the spot after the
                        end of your first name and then
                        adds 1 to R7 (it knows to increment
                        by 1 because outline is defined
                        as a block of bytes). Now R7 is
                        pointing to the spot after the
                        inserted space in OUTLINE
MOVC3   R6,BUFFER,(R7)  moves your last name into OUTLINE
                        beginning at the spot after the
                        space
INCL    R7              adds 1 to R7. Now R7 is pointing
                        to the spot directly after the
                        first letter of your last name
MOVB    #0,(R7)         places a byte of zeros where the
                        second letter of your last name
                        used to be.


PRINTCHRS MSG           prints from the beginning of MSG
                        until it encounters a byte of zeros.
                        This is directly after the first
                        letter of your last name. The
                        PRINTCHRS output, therefore, terminates
                        after the first letter of your last name.
```

By replacing INCL R7 with ADDL2 R6,R7 you will be incrementing R7 by the length of your last name, and R7 will be pointing to the spot after the end of your last name when it is used to address the placement of the terminating zero. PRINTCHRS will print out your entire last name before encountering the terminating zero I's like to be able to say that, just like Rana, I took a quick look at the program and found the mistake, but that's not true.

What I did was to run the program within the debugger. First I checked BUFFER to see whether the program was capturing my last name from the terminal correctly. All was well. Then I checked R6 to make sure that it held the correct length for my last name.

Finally, I looked at OUTLINE, and what I saw looked something like this:

Hello, Robin   T.anenbaum..............................

The dots represent unprintable characters. Binary zeros do not translate into something that the terminal can print, so it occurred to me that perhaps the dot after the T was the byte of zeros intended to tell PRINTCHRS to stop printing. I then went back to the source code and investigated the placement of those zeros.

So, Padma, give it a try and let me know how it goes.

- Robin

C 2134.4 CC 104.1 padma ganti (padma,11505)   2/28/94 3:01 PM 6 lines
Subject: Chapter 5, problem 19
+--+

Hi Robin,
Thank you for thdetailed answer. I thought I'd be able to do it , after I finished the Homework 5.Because I learnt a few things in the course of it. I did alter the program accordingly and got the output right, eventually.

Padma

C 2134.4 CC 104.2 Ajaz R. Rana (Rana,2134)   3/2/94 10:59 AM 3 lines
Subject: Chapter 5, problem 19
+--+

Good job Robin,

You fixed the exercise 19 chapter 5.

4 Answering Students' Questions:

Often times students would post a comment full of questions containing references to examples in the text and end-of-chapter exercises. Sometimes I would encourage other students to try and answer the questions. However, if I felt that the questions require a knowledge of topics that I had not discussed in a great length, I would go ahead and answer them myself. Generally, I made a copy of students' questions and inserted my comments in response to each question.

It was a time consuming but satisfying process. Students' questions and my comments were viewable by eveyone in the class. In a traditional class room environment such an activity could easily consume more than one full session.

5 Feedback from Students:

Following are some comments made by students about the course and the instructor.

C 2134.4 CC 4.22 2/7/94 6:17 PM 21 lines R: 1/1
sandeep d furia cis stnt 11068 (sandeep d furia cis stnt 11068,11068)
Subject: HOMEWORK 1 - Introduction
+---+

Hi! My name is Sandeep D. Furia. I am a sophomore and this is my second semester at NJIT. I transfered here in Fall'93 from Bombay. Back in Bombay I finished 2 years of the 4-year Computer Engg. course at the University of Bombay. I am glad to be in this class and am looking forward to a nice and properous semester for all of us.

Prof. Rana I just wanted to tell you that you are a pretty good teacher and also that you you do pretty well in front of the camera. It's a pleasure to be in your class.

C 2134.4 CC 65 padma ganti (padma,11505) 2/15/94 7:09 AM 5 lines
Subject: Tape status
+---+

Rana,
I got the tape lessons 4,5,& 6 yesterday. It is so convenient to attend the tape lesso and replay certain parts if I don't follow.I'm glad that such an innovative technique is available to us.
Ganti

C 2134.4 CC 129 (ANONYMOUS) 3/12/94 10:59 PM 11 lines R: 1/1
Subject: Thank you for Help!!
+---+
Hello Rana,
I would like to say thank you for taking the time out to spend with us this morning. I found it extremely helpful and you did manage to clear a few doubts. I must say that for me personally this class is turning out

to be an extreme success. I feel you must be commended on the job you have done thus far. My only regret is that the delivery of the tapes to the other students in the class could not have been more timely. I trust that that is one of the kinks that would be ironed out for the next class hence making it a success for everyone and not just a few. Again thank and keep up the good work.

C 2134.4 CC 217 YASHWANT (YASH,11139) 5/12/94 9:19 AM 15 lines
+---+

Professor Rana, Ftf Students, Distant Students,

Rana first of all I would like to congratulate on the Job well done. This was the first time I saw a Teacher handling his students and a camera at the same time. This was my first semester here and being in your class itself makes it definitly a very positive experiance. Rhonda, Udaya, Sandeep thanks for helping on my problems. Everybody Have a wonderful summer and a very bright future. Professor Rana thanks a lot for everything ones again. I really liked the subject, to be prcise i loved decoding the machine code. Well anyway have the best in life and good luck for everythin. Professor Rana and everybody keep in touch.

C 2134.4 CC 216 Robin S. Tanenbaum (Robin,11023) 5/11/94 8:57 AM
14 lines Subject: Farewell R: 1/9
+---+

Rana, Face-to-face Students, Distance Students,

Goodbye from me, too. I very much enjoyed sharing this course with all of you. Rana and ftf friends, thanks for all of the work you put into making the tapes. They were very well done and a big help in understanding the material. In spite of the tape delivery problems, I'm glad to have taken this class the first time around. It was special to see you folks and to hear your voices and then to be able to chat with you on VC. Other distance students, thank you, too. I thought of you often and was glad to have your partnership in this alternative learning experience.

Lots of luck to everyone, and a good summer. I hope we meet again - either in person or on-line.

C 2134.4 CC 212.1.1 Arthur Soto (Art,11511) 5/6/94 3:36 PM 13 lines
Subject: Final Farewell R: 1/1
+--+

Prof Rana,

This was my first distance course and i enjoyed it very much. I wish that I had done more homework assignments but that is another story. Thank YOU for your help and allowing me to borrow your tapes during the notorious "tape delay of 94". Partly due to success of this course, I plan on taking the summer course of Operating Systems on VC. I hope to do well. Thank you very much, Professor,and have a good summer class!

Art

C 2134.4 CC 213 Sandeep D. Furia (Sandy,11068) 5/7/94 7:31 PM
18 lines Subject: Farewell
+--+

Sir:

First of all I would like to thank you for everything. It was truly a pleasure being in your class. Your was a lot of fun, I don't know if "fun" is the right word because one thing I know for sure "study is not fun", atleast not for me. So now you are thinking, What am I trying to say here? Well I guess what I'm trying to say here is that your class was pretty smooth, it never got me head over heels. You are a good teacher, and you were pretty good on the "Distance CIS 231 Show" too. Job well done. You deserved that or rather you earned it.

I want to take this opportunity to say good-bye to my fellow classmates, from the CIS 231 point of view, because I'm pretty sure that I'll be running onto most of view on campus and those who I won't be running onto, "I bid you farewell". Rhonda, I wish you all the best for your career, "Go get 'em".

Chao.

Sandeep D. Furia

C 2134.4 CC 214 padma ganti (padma,11505) 5/9/94 4:26 PM 5 lines
Subject: Farewell
+--+

Rana,
Thank you for a very interesting course and the committment with which you conducted it.Wish you all the best and enjoy your trip to India.
Ganti

C 2134.4 CC 216.1.1 Robin S. Tanenbaum (Robin,11023) 5/13/94 11:24 AM
8 lines Subject: Farewell reply R: 7/7
+--+

Hi, Art!
I'm sure I'll be taking more distance courses - it's so much more convenient than having to drive an hour to get to Newark - but as to which and when, I don't know. Enjoy your summer course. If you get a chance, let me know if you find it to be a good one to take through distance learning. Happy end of finals week!

- Robin

C 2134.4 CC 219 John R. Quintin (JQ,11506) 5/16/94 11:59 AM 9 lines
Subject: Farewell
+--+

Hello:
I would like to commend prof. Rana on a job well done. Because of his excellent work I have registered for a distance learning class during th summer and will probably do a few more in the fall. I would like to congratulate all distance learner on their hard work and it was indeed a pleasure asking questions and getting the different view points.
Again thank you all and have a great summer.
JQ!

6 Descriptive Statistics:

Tables 1 shows students' final grades, and number of comments and number of lines written by each student in both sections. Table 2 presents the same data as percentages. The withdrawal rate for distance section (38%) was higher than the FtF section (9%). Six students withdrew from the distance section, whereas there were only two students who received a W grade in FtF section. The proportion of students receiving an A grade for the course was almost the same. One student received an F grade in distance section compared to none in the FtF section.

The number of lines written by students (as noted in tables) do not include any of their homework. Students mailed their homework to a different machine.

It is interesting to note that distance students wrote almost the same number of items as their instuctor. Number of items entered by students in the FtF section (111) were less than half of Disatnce students (264). It is also evident that female distance students took more active part in class discussions than male students.

Member	Items	Lines	Final Grade
Instructor			
Ajaz_R._Rana_(Rana,2134)	265	9534	
Distance_Section			
Thomas McCarrick (mac,3042)	7	26	D
Robin S. Tanenbaum (Robin,1102	95	991	A
Jeff Venetta,111777 (JJV,11177	12	106	A
priya modh (priya,11502)	1	7	W
william c. Jones (willie,11501	1	3	D
Marisol Zambrano (Marisol,1150	3	13	F
padma ganti (padma,11505)	78	940	A
John R. Quintin (JQ,11506)	13	114	B+
Jim Cruz (Jimc,11507)	1	3	W
Cynthia Stallings (CAS,11509)	25	321	W
Marie Kasper (ghost,11510)	6	36	B+
Arthur Soto (Art,11511)	22	212	B
Karen Illovsky			W
Michael Morris			W
Pasquale Piserchia			W
Mathew_Thomas			D
Face-to-Face_Section			
James C Wooster (The GREAT MUG	6	39	I
Sandeep D. Furia (Sandy,11068)	25	722	A
Rhonda L Williamson (Booboo,11	14	180	A
Edward George O'Connell (Eddie	1	11	D
anish n shah coe stnt 11094 (a	6	51	B
Ian Daniel Plotkin (Ian,11095)	1	8	B
douglas l stettler cis stnt 11	9	59	C
meena guruswami cis stnt 11097	1	5	C
UdayaRani Mukunda (Udaya,11098	2	27	A
on y woo cis stnt 11100 (on y	4	97	C+
richard mallet rutg stnt 11101	5	55	B+
ilya shinkaryov cis stnt 11103	2	13	B+
cu s hoang cis stnt 11105 (cu	2	13	C+
stephen a ragonese eet stnt 11	2	19	W
YASHWANT (YASH,11139)	12	165	A
Adnan Faizi (Adnan,11156)	1	3	B
jolene m williams rcis stnt 11	1	5	C
omar riaz cis stnt 11171 (omar	5	20	B
Rashmi Lad (Rash,11176)	10	126	B
joseph tommasi cis stnt 11206	2	8	B

Lamour Gaspard			C
Dionisio Villanueva			W
Anonymous			
(ANONYMOUS)	4	38	

Table 1: Grades and Written Participation

Summary Participation and Grades											
			Grade (%)								
Section	Comments	Lines	A	B+	B	C+	C	D	W	F	I
Distanc	264(41.25%)	2772(19.90%)	19	12	6	0	0	19	38	6	0
FtF	111(17.34%)	1626(11.67%)	18	9	27	9	18	5	9	0	5
Instrct	265(41.41%)	9534(68.43%)									
Total	640	13932									

Table 2: Summary of Grades and Written Participation

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